# *Eogammarus confervicolus*

Phylum: Arthropoda, Crustacea
Class: Malacostraca
Order: Amphipoda, Gammaridea
Family: Anisogammaridae

**Taxonomy:** Originally described as *Maera confervicolus*, *E. confervicolus* has undergone various generic designations including *Gammarus* and, most recently, *Anisogammarus*. In 1979, Bousfield revised the family Anisogammaridae and promoted *Eogammarus* to generic rank comprising 10 species (including *E. confervicolus,* Tomikawa et al. 2006). Species within this genus remain difficult to identify, however, because original descriptions often lack sufficient detail.

## Description

**Size:** Individuals up to 19 mm. Male specimens range locally from 12 mm (South Slough of Coos Bay) to 16 mm in length (Siuslaw Estuary).

**Color:** White with dark brown mottling and brown stripes on the first and second antennae.

**General Morphology:** The body of amphipod crustaceans can be divided into three major regions. The **cephalon** (head) or cephalothorax includes antennules, antennae, mandibles, maxillae and maxillipeds (collectively the **mouthparts**). Posterior to the cephalon is the **pereon** (thorax) with seven pairs of pereopods attached to pereonites followed by the **pleon** (abdomen) with six pairs of pleopods. The first three sets of pleopods are generally used for swimming, while the last three are simpler and surround the telson at the animal posterior. Amphipods in the Gammaroidea (including Gammaridae and Anisogammaridae) display weak sexual dimorphism (Chapman 2007). (For detailed key and description of *E. confervicolus* see Figs. 14–17 Tomikawa et al. 2006).

**Cephalon:**

**Rostrum:** Rostrum vestigial.

**Eyes:**

**Antenna 1:** Almost equal to ½ body length and with an accessory flagellum of five articles (Fig. 1). Longer than (or equal to) second antenna and with posterodistal spine on peduncle (Fig. 1) (*Eogammarus,* Bousfield 1979). Posterodistal setae on article one spiniform (Tomikawa et al. 2006).

**Antenna 2:** Stout, shorter than first and with 14 articles (Fig. 1). Peduncles four and five with two (rarely three) posterior marginal groups of setae (in addition to terminal group) (Bousfield 1979; Tomikawa et al. 2006).

**Mouthparts:** Mandible with palp, molar large and bears rasping surface. No palp setae on the first article of maxilla one (Tomikawa et al. 2006).

**Pereon:**

**Coxae:** First four coxal plates become gradually larger and the fourth is rounded (Fig. 1) while plates 5–7 are quite small.

**Gnathopod 1:** Slightly smaller than second gnathopod. Article six with palm oblique, nine peg-like teeth and dactyl curved (Fig. 2a).

**Gnathopod 2:** Much like the first gnathopod, but larger and palm with seven stout pegs (Fig. 2b).

**Pereopods 3 through 7:** Strong, becoming larger posteriorly and spinous but without plumose setae on margins of basis and carpus (Tomikawa et al. 2006).

**Pleon:**

**Pleonites:** No dorsal spines and only 0–2 posterior marginal setae (Fig. 1).

**Urosomites:** Urosome one with four dorsal groups of three spines each. Urosome two with dorsal spines in two groups and no prominent median tooth (Fig. 3) (key taxonomic character, Bousfield 1979). Uropods one and two with 2–4 groups of spines. Uropod two with rami extending beyond peduncle of uropod three (Fig. 1) (Bousfield 1979). The inner margin of the outer ramus in uropod three usually with four groups of strong spines, but less than 10 isolated plumose setae. The inner ramus is

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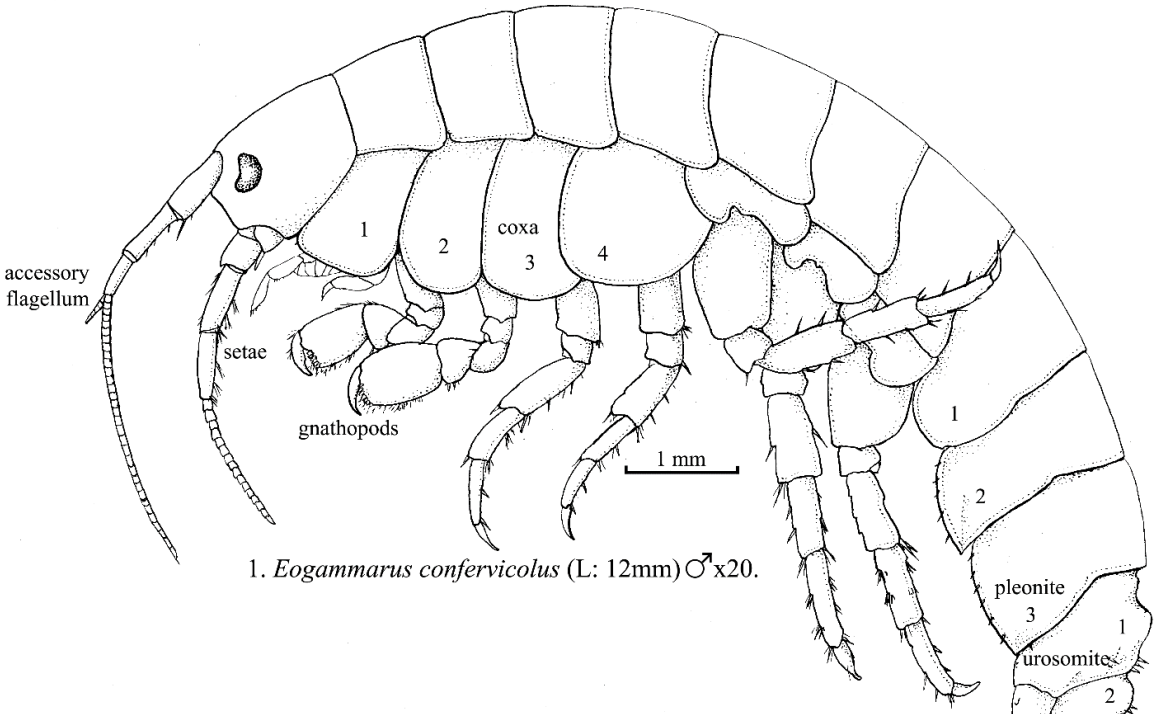
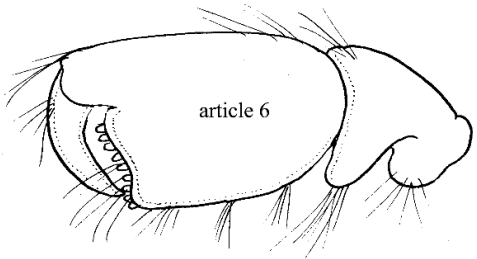
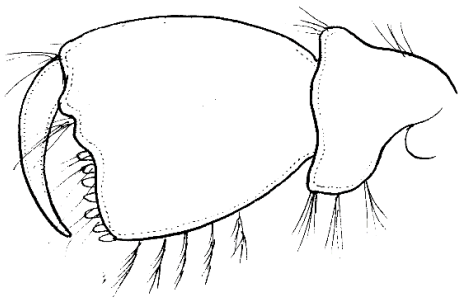
# *Eogammarus confervicolus*



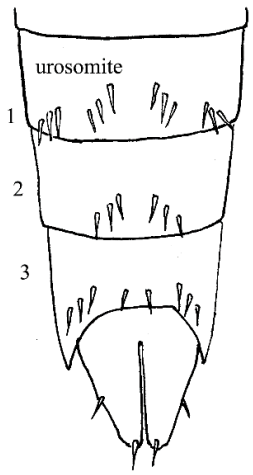

1. *Eogammarus confervicolus* (L: 12mm) ♂x20.



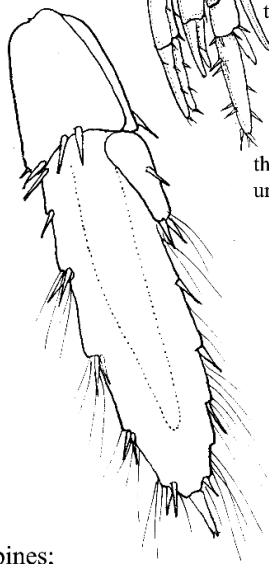

2a. First gnathopod ♂:
9 pegs, strongly curved dactyl.



2b. Second gnathopod ♂:
7 pegs, 5 fascicles; narrow dactyl.




3. "Basic" gammarid split telson, connected lobes, each with two spines; urosomites: stout spines aligned anterior to posterior.



4. Third uropod with small inner branch.

less than ½ length outer ramus (Fig. 4) (Bousfield 1979).

**Epimera:**

**Telson:** Split, with connected lobes each with two spines, and only one spine is apical (at the tip) (Fig. 3). *Eogammarus confervicolus* and *E. oclairi* can be differentiated by telson characters, as the latter species only has one spine on each lobe. However, it is currently unclear whether this feature is representative of two species, or if *E. oclairi* is simply large *E. confervicolus* (Bousfield 1979; Chapman 2007).

**Sexual Dimorphism:** Sexual dimorphism is relatively weak among the Gammaroidea compared to other amphipod families. Female and male *E. confervicolus* differ very little, if at all. Females can be smaller, have smaller **gnathopods**, and shorter **antenna** than do the males.

## Possible Misidentifications

Gammaroidea comprises the two amphipod families Anisogammaridae and Gammaridae. The Gammaridae is characterized by gnathopods of dissimilar size (males), palms oblique and with simple spines and slender simple dactyls. They also have simple coxal gills without accessory lobes and urosome segments with posterodorsal spines in groups of three (Bousfield 1979). The Anisogammaridae, on the other hand, have gnathopods that are morphologically subsimilar, have palms with margins vertical and lined with blunt spines and massive dactyls with posterior accessory blades. They also have coxal gills with accessory lobes and urosome segments with posterodorsal spines in clusters of two or four (Bousfield 1979, 2001). The Gammaridae includes three species in the genus *Gammarus* locally, none of which are certain to be native (Chapman 2007). The Anisogammaridae includes seven local species including one in the genus *Anisogammarus*, four in the genus *Ramellogammarus* and two in *Eogammarus* (Chapman 2007).

The genus *Eogammarus* is characterized by uropods one and two with rami linear and with apical margins spinose, urosome segments one and two with 2–4 groups of spines and peduncular segments one and two with 2–3 groups of posterior marginal setae (Bousfield 1979). The only other species of *Eogammarus* in the northeastern Pacific region is *Eogammarus oclairi*, a pelagic estuarine form very like *E. confervicolus*. Both have robust setae on article one of antenna two and no marginal setae on the palp of article one on maxilla one. They can be differentiated by each telson lobe, which has two terminal setae, in *E. oclairi*, not one as in *E. confervicolus* (Bousfield 1979). Additional characters include the following (see Tomikawa et al. 2006): aesthetasc of flagellum on antenna one is equal to setae in *E. confervicolus* and longer in *E. oclairi;* female calceoli on antenna two are absent in the former species and present in the latter; the longest setae on pereopod six is half the width of the ischium in the former and shorter in the latter species; and the robust telson setae are equal to or shorter than the slender setae in *E. confervicolus*, but longer in *E. oclairi* (Tomikawa et al. 2006). Despite these characters, it remains a possibility that *E. confervicolus* and *E. oclairi* are the same species and the above variations are simply due to individual size (Chapman 2007).

Members of the closely related genus *Anisogammarus* have first antenna shorter than the second (the most distinctive character) (Bousfield 1979). In *Anisogammarus,* each of the urosomites has a prominent median tooth and a smaller pair of dorsolateral teeth, not 2–4 groups of spines as in *Eogammarus*. Finally, on uropod three, the rami are subequal, not disparate in size as in *Eogammarus*. *Anisogammarus pugettensis* has a prominent fixed median spine on its second urosomite and no rows of spines (Bousfield 2001).

Another closely related genus is *Ramellogammarus*, characterized by dorsal groups of spines on its pleon segments: groups of 1–3 on urosomes one and two; urosome three with 1–2 posterodorsal groups of spines; and 1–4 groups of posterior marginal setae on peduncle segments of both first and second antennae (Bousfield 1979; Bousfield and Morino 1992; Chapman 2007). *Ramellogammarus oregonensis* and *R. ramellus* were both previously members of *Gammarus*,

*Anisogammarus* and *Eogammarus.* *Ramellogammarus oregonensis* is strongly armed on pleonites 1–3, while *R. ramellus* has a single posterior seta on pleon plate three (Bousfield and Morino 1992). The two other species in the genus *Ramellogammarus* are freshwater species, *R. columbianus*, and *R. littoralis* (Chapman 2007).

## Ecological Information

**Range:** Type locality is in California (Tomikawa et al. 2006), but specific locale was not found. Known range includes San Diego, California to Alaska.

**Local Distribution:** Local distribution includes sites in South Slough (e.g. *Salicornia* marsh and Metcalf Preserve). Also occurs on log booms and in mud (e.g. South Slough, Siltcoos River, Siuslaw Estuary) (Barnard 1954).

**Habitat:** Muddy substrates. *Eogammarus confervicolus* gets name from the "conferva" or long green algae on which it lives. Also occurs with *Salicornia, Carex* and *Fucus* (Straude 1987). Growth of *E. confervicolus* was compared between three habitats and ranked as follows: highest in an embankment along the perimeter of a marsh, medium along the edge of a *Fucus* community and lowest in habitat dominated by woody debris (Stanhope and Levings 1985). Little migration occurs between different adjacent substrates, and can result in genetically different races (Stanhope et al. 1992; Stanhope et al. 1993).

**Salinity:** Full salt water to brackish water (range 5–25, Stanhope et al. 1993).

**Temperature:**

**Tidal Level:** Intertidal to 30 meter depths (Bousfield 1979; Chapman 2007). Occurs in drainage channels in South Slough of Coos Bay (+1.4 meters).

**Associates:** Associates include the isopod, *Gnorimosphaeroma insulare*, (South Slough of Coos Bay) and the amphipod, *Corophium slamonis* (Siuslaw Estuary).

**Abundance:** Often occurs in great numbers and is the most common gammaroidean amphipod on the Pacific coast of North America (Bousfield 1979). Up to 25,000 individuals per $m^2$ comprising 5% of total benthic fauna in June and 17% in August (Sixes River, Martin 1980). Populations can increase rapidly, as was found in Suisun Marsh, California, where *E. confervicolus* were introduced to a wetland pond in September and became a numerically dominant member of the pond by February (Batzer and Resh 1992).

## Life-History Information

**Reproduction:** Most amphipods have separate sexes with some sex determination correlated with environmental conditions (Straude 1987). Females brood embryos in an external thoracic brood chamber and irrigate embryos with a flow of water produced by pleopod movement. Development within this brood chamber is direct and individuals hatch as juveniles that resemble small adults, with no larval stage. The reproduction and development of *E. confervicolus* was described by Rappaport (1960). Reproductive behavior and coupling occurs nine days prior to mating. Females are ovigerous from October to December and, again, from June to August (Bousfield 1979). Brood size ranges from 10 to 75 embryos and duration within the brood is 17 days at 10˚C and a salinity of 15 (Straude 1987).

**Larva:** Since most amphipods are direct developing, they lack a definite larval stage. Instead this young developmental stage resembles small adults (e.g. Fig. 39.1, Wolff 2014).

**Juvenile:**

**Longevity:**

**Growth Rate:** Amphipod growth occurs in conjunction with molting where the exoskeleton is shed and replaced. Post-molt individuals will have soft shells as the cuticle gradually hardens (Ruppert et al. 2004).

**Food:** Detritus, particularly from algal or vascular plant material. Research has shown that *E. confervicolus* will readily ingest *Zostera marina* leaves (Harrison 1982), *Enteromorpha linza* and *Pylaiella littoralis* (Pomeroy and Levings 1980) and individuals are capable of ingesting up to 0.21 mg *Ulva* per individual per day (Price and Hylleberg 1982). Ingestion of different algal substrates (e.g. *Fucus distichus* and *Pelvetia fastigiata*) can manifest distinct pheromones between substrate-specific, but geographically close, populations (Stanhope et al. 1992).

**Predators:** Fish (e.g. juvenile salmonids, Parsons 1985), birds and mallards (Batzer et al. 1993).
**Behavior:**

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